

# Body size in Hastings River Mouse *Pseudomys oralis* (Rodentia: Muridae) from new and old locations

D. G. Read

School of Biological Science, University of New South Wales, P.O. Box 1, Kensington, New South Wales, Australia 2033

This paper presents information on the geographical distribution of the rare rodent, *Pseudomys oralis*. Body measurements are given on 15 male and 30 female adults, representing almost 30 per cent of the total number of adults known. *Pseudomys oralis* is similar in appearance to a common species, *Rattus fuscipes* and features that distinguish these species are described. Possible confused identification with the common rat species may partly account for the paucity of locality records for *P. oralis*. History has shown that for a few species their status as rare was partly due to inaccurate identification in the field. The rare species was too readily confused with a common species. However, once this confusion was recognized and correct identifications made, then in many cases the rare species was found to be more common. This may be the situation with the rare Hastings River Mouse, *Pseudomys oralis*.

There is little information available on the distribution and biology of *P. oralis*. Although two specimens were found in the 1840s it was not until 1969 that other specimens were recognized (Watts and Aslin 1981). To date the total number of captured individuals is at least 150. More than 70 per cent of these have been captured since 1985, due to the increased number of surveys specifically for this species.

*Pseudomys oralis* is known from widely separated localities and the new locations reported here indicate that their distribution is more continuous than previously thought, albeit in very low densities (Map 1). The species was found in creeks and gullies, but some sites were in open forest with a grassy understorey. Sedges, mainly Cyperaceae and Juncaceae, were present at all sites. The photographs show some of the habitats and capture sites of *P. oralis*. In the Mount Royal State Forest two individuals were caught within a small patch of sedges which was approximately 8 m × 15 m in area. Sites in this state forest occur in terraces, in gullies and on ridges between gullies.

The July 1993 captures of the Hastings River Mouse in the Mount Royal State Forest extend its known range within this region by more than 4 km northwards into the Davis

Creek catchment and by 2.5 km further south in the Fal Brook catchment. There are now five known localities in this state forest and potentially suitable habitat occurs in the adjoining Barrington Tops National Parks and surrounding private land.

I captured animals at 12 localities in the ranges from Mt. Royal (Barrington Tops) 32°10'5"S, 151°19'3"E), north to Billilimbra State Forest (south-west from Casino) (29°14'43"S, 152°20'45"E); all within the known geographical range of *P. oralis*. Twenty-five of the 48 individuals were trapped at nine previously unpublished locations (Table 1). Separate localities for the species are defined as places where a capture site is more than 1 km from any other capture site. The species was first found at two of these sites in October and December 1990 prior to my trapping: respectively, at Billilimbra by A. Gilmore, and at Clouds Creek by T. Tweedie.

Previous published information on the body dimensions of this species has been based on one or only a few individuals (Watts and Aslin 1981; Kirkpatrick 1983; Dickman and McKechnie 1985). The range in head plus body length given by these authors is 130–170 mm and the tail length slightly shorter; hind-foot length 30–34 mm; and mass 90–100 g. However, there is information based on more individuals from several unpublished reports in files and libraries of the Forestry Commission of NSW at Coffs Harbour, Newcastle, and Pennant Hills (Read 1988, 1989a, 1989b).

In this paper I report measurements taken on 45 live adult individuals that I captured during the period 1987–93, including those in Read (1988, 1989a, 1989b) (Table 2). Females with a mass of 55 g had perforated vaginas and this mass was used as the lower limit for classification as adults. Body measurements followed the definitions in Watts and Aslin (1981) with the minor change that the head plus body length (HBL) was taken from the nose tip to the tail base (measured dorsally) and not the total length minus the tail length (TL). I included the head length (HL) as the length from the nose tip to the occipital at the back of





Fig. 1 (above). Hastings River Mouse. This adult female weighed 89 g. She was captured in the Clouds Creek State Forest in an open forest with a grassy understorey on flat ground. Clumps of sedges are found scattered through the grassy groundcover.  
(Photograph: Michelle Thompson.)



Fig. 2 (above). Taking a head length measurement. The long soft fur, its open fluffy texture, and its dark grey coloration to the basal two-thirds of the hair shafts are evident in this photograph.  
(Photograph: Michelle Thompson.)



Fig. 3 (above). The head plus body length is the most difficult to measure on a live Hastings River Mouse. In common with other members of the genus *Pseudomys*, the tail can not be pulled because the skin very easily breaks and strips off, leaving the raw flesh of the tail. This raw tail dies and drops off leaving a stump. Care is taken when pulling on the hind legs to bring the spine into a straight line.  
(Photograph: Michelle Thompson.)

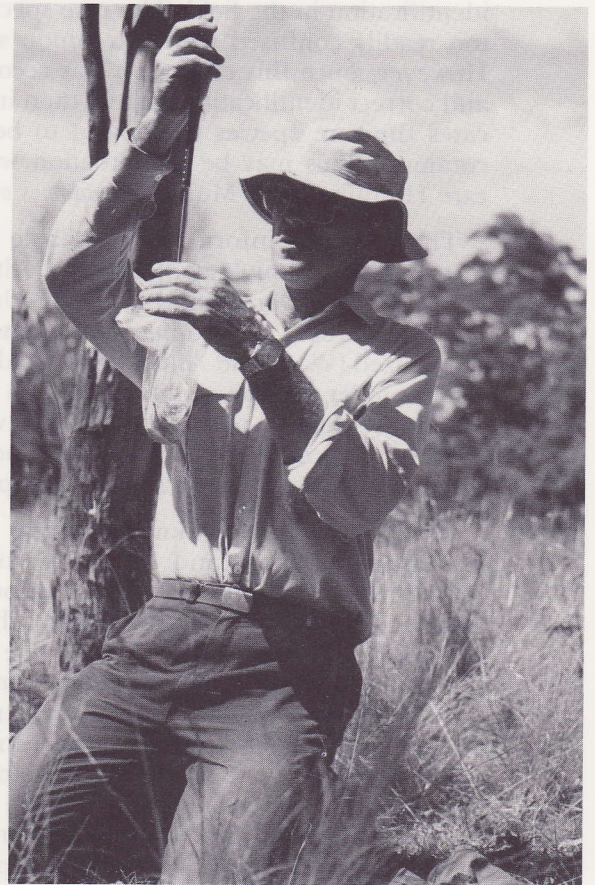


Fig. 4 (above). The author weighing a Hastings River Mouse in a plastic bag. The surrounding grass is typical of *P. oralis* habitat in Clouds Creek State Forest  
(Photograph: Michelle Thompson.)

Fig. 5 (left). A male Hastings River Mouse (99 g) photographed in its habitat beside Hyland Creek, Blinks River Flora Reserve. The proportionally large testes are evident.



Map 1. The region of eastern Australia that contains the extant distribution of *Pseudomys oralis*. The area below 500 m elevation is shaded grey. Places numbered on the map are referred to in the following table which shows the dates when individuals were caught, the vicinity and source of the data.

Place No.	Date month/year	Vicinity	Source
1	n.a./1969	Main Range N.P.	Kirkpatrick and Martin (1971)
2	n.a./1969	Swan Creek	Kirkpatrick and Martin (1971)
3	n.a./1969	Emu Vale S.F.	Kirkpatrick and Martin (1971)
	n.a./1969	Gambubal S.F.	Kirkpatrick and Martin (1971)
4	8/1993	Gambubal S.F.	S. Phillips, pers. comm.
	*10/1981	Werrikimbe N.P.	L. Gibson, pers. comm.
	2/1982	Werrikimbe N.P.	King (1984)
	*10/1984	Werrikimbe N.P.	S. Phillips, pers. comm.
	*3/1991	Werrikimbe N.P.	S. Wilkes, pers. comm.
5	10/1982	Blicks River F.R.	King (1984)
	10,11/1984	Hyland S.F.	T. Tweedie, pers. comm.
	*2/1985	Blicks River F.R.	G. King, pers. comm.
6	10/1984	Mount Royal S.F.	Dickman and McKechnie (1985)
	1/1988	Mount Royal S.F.	Read (1988)
	7/1989	Mount Royal S.F.	Read (1989a)
7	12/1984	Forest Land S.F.	King and Mackowski (1986)
	2/1985	Forest Land S.F.	King and Mackowski (1986)
8	2/1985	Marengo S.F.	King and Mackowski (1986)
	12/1987	Marengo S.F.	Read (1988)
9	12/1985	Werrikimbe N.P.	S. Phillips, pers. comm.
10	10/1987	Chaelundi S.F.	P. Catling, pers. comm.
	5/1988	Chaelundi S.F.	P. Catling, pers. comm.
11	11/1987	Blicks River F.R.	Read (1988)
	10/1988	Blicks River F.R.	D. Read, unpubl. data
	7/1989	Blicks River F.R.	Read (1989b)
12	7/1989	Wild Cattle Creek S.F.	T. Tweedie, pers. comm.
13	7/1990	Chaelundi S.F.	This paper
	*8/1992	Chaelundi S.F.	S. Phillips, pers. comm.
	7/1993	Chaelundi S.F.	T. Tweedie, pers. comm.
14	*9/1990	Dalmorton S.F.	A. Gilmore, pers. comm.
15	*10/1990	Billilimbra S.F.	A. Gilmore, pers. comm.
	6/1991	Billilimbra S.F.	This paper
	*7/1991	Billilimbra S.F.	S. Phillips, pers. comm.
	*11/1992	Billilimbra S.F.	S. Townley, pers. comm.
16	12/1990	Clouds Creek S.F.	T. Tweedie, pers. comm.
	2/1991	Clouds Creek S.F.	This paper
17	2/1991	Timber Reserve No.80004	P. Catling, pers. comm.
18	2/1991	Carrai S.F.	P. Catling, pers. comm.
19	2/1991	Werrikimbe N.P.	P. Catling, pers. comm.
	7/1993	Werrikimbe N.P.	P. Catling, pers. comm.
20	3/1991	Mount Royal S.F.	Shields <i>et al.</i> (1991)
21	8/1992	Carrai (Crown Land)	This paper
	*3/1993	Carrai (Crown Land)	A. Gilmore, pers. comm.
22	7/1993	Hyland S.F.	T. Tweedie, pers. comm.
23	7/1993	Mount Royal S.F.	This paper
24	7/1993	Mount Royal S.F.	This paper

\*Data obtained from the data base held by the National Parks and Wildlife Service of New South Wales. Abbreviations: n.a., not available; N.P., National Park; S.F., State Forest; F.R., Flora Reserve.

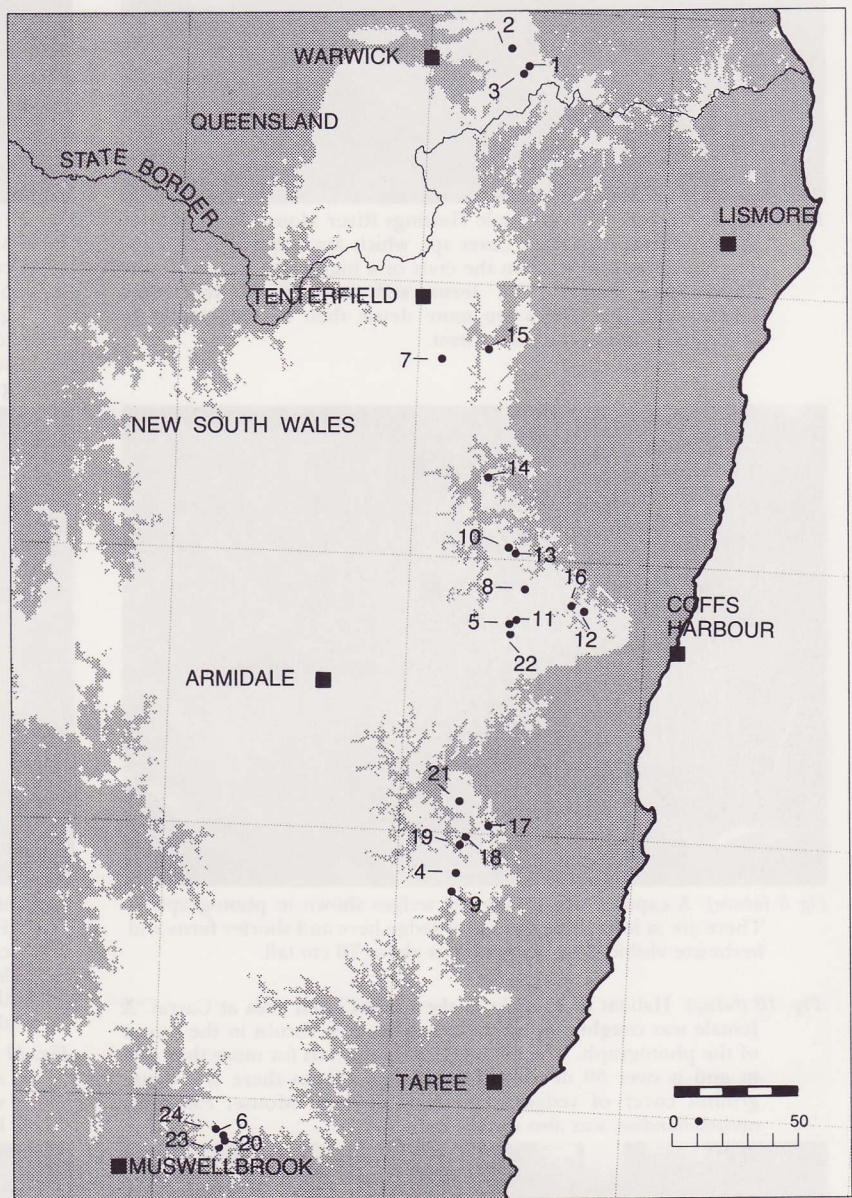






Fig. 6 (above). In July 1993 a female Hastings River Mouse was captured in this terrace of sedges, *Carex* sp., which are about 80 cm high. The site is only 40 m from the crest of a high ridge in the Mount Royal State Forest. The ferns and understorey vegetation surrounding the sedges are more dense than the vegetation at other drier sites in the state forest.



Fig. 7 (above). A terrace of suitable habitat in the Davis Creek area of Mount Royal State Forest. Three individuals of *P. oralis* were caught here: among the ferns to the right foreground; at the edge of the shorter sedges lit by sunlight in the centre of the photograph; and at the edge of the tall reeds, *Phragmites* sp., in the middle distance (bleached in photograph). Suitable habitat at this site extends for nearly 150 m and is 10–20 m wide. The habitat is grazed and heavily trampled by brumbies.



Fig 8 (above). A capture site among the sedges shown in photograph 7. There are at least three species of sedge here and shorter ferns and herbs are visible. The vegetation is about 70 cm tall.

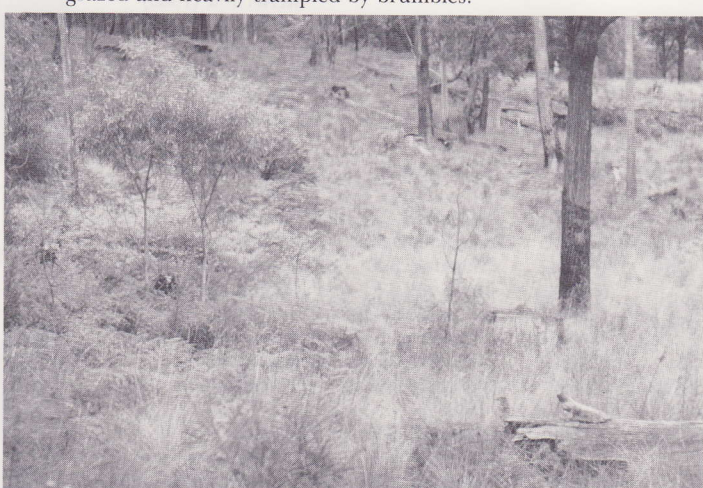


Fig 9 (above). This flat area of sedges and grasses in the Mount Royal State Forest is home to the Hastings River Mouse and several were caught in the area from the log to the ferns and blackberries to the left of the photograph. A seepage of water runs down the slope in the background to saturate the flat area before flowing on down the slope to Fal Brook.

Fig. 10 (below). Habitat of *P. oralis* in the Crown Land area at Carrai. A female was caught among the green tea-tree shrubs in the centre of the photograph. The flat boggy area extends for more than 100 m and is over 50 m wide. Beneath the shrubs there is a dense ground cover of sedges. The New Holland Mouse, *Pseudomys novaehollandiae*, was also caught here.



Fig. 11 (below). Capture site of *P. oralis* at Carrai. Among the grasses there are several sedge species. This capture site is at the head of a gully where water seeps to the surface forming boggy conditions. Gully heads like this one are often good habitat for *P. oralis*.



Table 1. Some new locations for *Pseudomys oralis*.

Location	Latitude	Longitude	Number caught	Date
Billilimbra S.F.	29°14'43"S	152°20'45"E	7	29/6/1991
Chaelundi S.F.	29°56'38"S	152°26'59"E	1	21/7/1990
Chaelundi S.F.	29°58'00"S	152°28'47"E	1	21/7/1990
Chaelundi S.F.	29°59'10"S	152°27'01"E	2	21/7/1990
Clouds Creek S.F.	30°09'41"S	152°40'49"E	2	10/2/1991
Carrai (Crown Land)	30°52'30"S	152°15'00"E	5	25/8/1992
Mount Royal S.F.	32°08'47"S	151°17'15"E	3	23/7/1993
*Mount Royal S.F.	32°11'21"S	151°18'18"E	2	23/7/1993
*Mount Royal S.F.	32°11'32"S	151°18'40"E	1	27/7/1993
Mount Royal S.F.	32°12'07"S	151°17'43"E	1	29/7/1993

\*These sites are 700 m apart and form one location.

Table 2. Body measurements taken on *Pseudomys oralis* adults: M, male; F, female. See text for abbreviations.

Body parameter	Sex	Mean	Standard error	Sample size	Range
HBL (mm)	M	148.0	6.5	15	135–160
	F	146.0	9.0	29	125–165
TL* (mm)	M	143.4	11.6	14	120–160
	F	148.6	10.7	24	130–165
HL (mm)	M	40.4	1.1	15	38.1–42.0
	F	40.3	1.6	30	36.7–43.7
HFL (mm)	M	32.1	0.9	15	30.5–33.5
	F	31.4	1.3	30	28.2–33.7
Mass (g)	M	82.3	9.7	15	65–99
	F	74.6	11.2	30	55–99

\*Some individuals had short tails due to previous injury and were excluded from the analysis.

the skull. Measurements of HBL and TL were recorded to the nearest 5 mm graduation on a straight rule, but the HL and hind-foot length (HFL) were recorded to the first decimal place using vernier callipers. Differences between sexes are not significant and there is no sexual dimorphism in this species (Table 2). This is demonstrated for head length, which is the measurement likely to show least variation. Mean values for each sex are almost identical. The maximum dimensions reported here are in agreement with previous reported measures, although the larger sample reported in this paper included animals smaller than reported previously.

To date there is no published description of *P. oralis* juveniles and in Table 2 I did not include three young individuals: a juvenile male, 16 g; and two sub-adult females, 47 g and 48 g. The fur on the head and body of the juvenile male was a smoke-grey colour but the distinguishing features of this species; black eye-ring, white feet and bi-coloured tail, were obvious. Some of this grey colour was still evident in the sub-adult females, although the adult coloration was predominant.

Throughout its range *P. oralis* is frequently found in habitats shared by the Swamp Rat, *Rattus lutreolus* particularly, and the Bush Rat, *R. fuscipes*. Swamp Rats have short dark tails, dark feet and dark grey to dark brown fur and

are unlikely to be confused with *P. oralis*. However, *R. fuscipes* looks superficially very similar to *P. oralis* and captures of what appeared to be juvenile or sub-adult *R. fuscipes* may have been *P. oralis*. Such possible confusion may partly account for the lack of locality records and also for the lack of records between the 1840s and 1969. Perhaps due to this similarity *P. oralis* has been confused with *R. fuscipes* and so overlooked. In Appendix 1 I describe some features that help to distinguish between the two species.

## ACKNOWLEDGEMENTS

The scope of this paper was greatly enhanced by critical comments from two referees and the editor. Financial assistance for some of these surveys was provided by the Ethel Mary Read Research Fund from the Royal Zoological Society of New South Wales. The majority of the surveys was funded by Earthwatch and its Research Corps. I am grateful to the 60 Earthwatch volunteers for field assistance and to the Forestry Commission of New South Wales for the substantial support of staff, vehicles and accommodation for the Earthwatch expeditions. Data also came from surveys conducted under Special Purpose Permits and specific survey agreements with the Forestry Commission. National Parks and Wildlife Service personnel, particularly Mr Murray Ellis, provided substantial assistance with the





Fig. 12 (above). Not all capture sites of *P. oralis* have lush vegetation. A very small trickle of water along this rocky gully in the Marengo State Forest was sufficient to maintain clusters of sedges. A female *P. oralis* was caught here in 1987.



Fig. 14 (above). A full grown male Hastings River Mouse (87 g) captured in the Mount Royal State Forest in July 1993. Distinguishing features of this species are the fine ring of black hairs around its eye and, perhaps not clear in this photograph, the black hair on the top of its tail but white hair on the underside of the tail. It is the colour of the hair on the tail that is significant, not necessarily the colour of the skin. The hair on the tail of *P. oralis* is nearly twice the length of hair on a Bush Rat's tail. Bush Rats have short grey hairs on their tails. (Photograph: G. A. and M. M. Hoye.)



Fig. 16 (above). Habitat of the Hastings River Mouse in a gully in the Mount Royal State Forest. Beneath the ferns, sedges and grasses water trickles over rocks and soaks through gravel beds; just the conditions favoured apparently by *P. oralis*. Capture sites in gullies elsewhere do not have such a high cover of ferns but the sedges and grasses are typical of these habitats. (Photograph: G. A. and M. M. Hoye.)



Fig. 13 (above). Habitat of *P. oralis* in Chaelundi State Forest where a female was caught in July 1990. Further up this gully a small seepage supplied water to nourish the sedges that grew in clusters around the patches of gravel in the gully bed.



Fig. 15 (above). A close-up of a male Hastings River Mouse (87 g) captured in the Mount Royal State Forest. All individuals are numbered in sequence of their capture and a small hole punched in the point of its right ear identifies this animal as No. 2. By using different positions and both ears, these holes form a system of permanent marks. (Photograph: G. A. and M. M. Hoye.)



Fig. 17 (above). An undescribed species of parasitic mite on the eyelid of a Hastings River Mouse. These mites would get on to the eyelid like this one for a few moments, as though drinking, before scurrying back into the fur. Most individuals carry these very active parasites, which may be almost host specific. Only twice have I noticed these mites on other small mammals and in each instance they were parasites on Bush Rats, *Rattus fuscipes*. (Photograph: G. A. and M. M. Hoye.)



cartography. Trapping equipment was borrowed from the Royal Zoological Society, the University of New South Wales, Charles Sturt University — Mitchell and Mount King Ecological Surveys. Drs Barry Fox and Chris Dickman commented on a draft of the manuscript. Photographs are by the author except where credits are cited.

## REFERENCES

- DICKMAN, C. R. AND McKECHNIE, C. A., 1985. A survey of the mammals of Mount Royal and Barrington Tops, New South Wales. *Aust. Zool.* **21**: 531–43.
- KING, G. C., 1984. Habitat utilized by *Pseudomys oralis* Thomas (Rodentia: Muridae). *Aust. Mammal.* **7**: 139–47.
- KING, G. C. AND MACKOWSKI, C. M., 1986. Two new localities for *Pseudomys oralis* Thomas (Rodentia: Muridae) in New South Wales. *Aust. Mammal.* **9**: 63–65.
- KIRKPATRICK, T. H., 1983. Hastings River Mouse *Pseudomys oralis*. P. 394 in *The Australian Museum Complete Book of Australian Mammals* ed by R. Strahan. Angus and Robertson: Sydney.
- KIRKPATRICK, T. H. AND MARTIN, J. H. D., 1971. Uncommon native fauna. *Qld Agr. J.* **97**: 174–75 (cited in King 1984).
- LUNNEY, D., 1983. The Bush Rat *Rattus fuscipes*. Pp. 443–45 in *The Australian Museum Complete Book of Australian Mammals* ed by R. Strahan. Angus and Robertson: Sydney.
- READ, D. G., 1988. *Surveys for the Hastings River Mouse (Pseudomys oralis) in the Marengo, Hyland, and Mount Royal State Forests*. Report to the Forestry Commission of New South Wales: Regional Office, Coffs Harbour.
- READ, D. G., 1989a. *Captures of the Hastings River Mouse (Pseudomys oralis) in the Mount Royal State Forest, July 1989*. Report to the Forestry Commission of New South Wales: Regional Office, Newcastle.
- READ, D. G., 1989b. *Captures of the Hastings River Mouse (Pseudomys oralis) in the Blinks River Flora Reserve, July 1989*. Report to the Forestry Commission of New South Wales: Regional Office, Coffs Harbour.
- SHIELDS, J. M., YORK, A. AND BINNS, D., 1991. *Flora and fauna survey, Mount Royal management area, Newcastle Region*. Forestry Commission of New South Wales: Beecroft, New South Wales.
- WATTS, C. H. S. AND ASLIN, H. J., 1981. *The Rodents of Australia*. Angus and Robertson: Sydney.

## APPENDIX 1

Some features that distinguish the Hastings River Mouse, *Pseudomys oralis*, from the Bush Rat, *Rattus fuscipes*.

The similarity in coloration and body size makes it easy to confuse *P. oralis* with *R. fuscipes* unless one is aware of the subtle differences. Compare measurements for *P. oralis* (Table 2) with measurements for *R. fuscipes* obtained from Watts and Aslin (1981) and Lunney (1983). Measurements for *R. fuscipes*: HBL, mean 165 mm and range 90–205 mm; TL, mean 158 mm and range 105–195 mm; Mass, mean 125 g and range 65–225 g. The HFL in *R. fuscipes* ranges 23–40 mm. On average *P. oralis* is slightly smaller than *R. fuscipes* but there is substantial overlap in body size. Also, in *P. oralis* the tail is about equal to the head plus body length but in *R. fuscipes* the tail is slightly shorter than HBL. Ears of *P. oralis* are much thinner than the thick, fleshy ears of *R. fuscipes*. In profile, the nose of *P. oralis* is very rounded but the nose of *R. fuscipes* is straighter. Another physical difference is that females of *P. oralis* have only two pairs of teats set close together in the inguinal region. Females of *R. fuscipes* may have four or five pairs of teats; three well separated pairs in the inguinal region.

The dorsal body fur is similar in both species, being a light brownish-grey. Belly fur in *P. oralis* tends to be fawn to off white whereas in *R. fuscipes* it is light grey to brown. Fur on *P. oralis* individuals is long and tends to be softer, more open and fluffy in appearance compared with the more compact fur of *R. fuscipes* individuals. Hind feet of *P. oralis* have white hair which extends generally beyond the claws but feet of *R. fuscipes* individuals usually have pale grey hairs that do not extend beyond the claws. A distinguishing feature of *P. oralis* is that the hair on the dorsal surface of the tail is black but on the underside it is white. In *R. fuscipes* the tail hairs, above and below, are uniform pale grey. The tail hair is

noticeably longer in *P. oralis* than in *R. fuscipes*. The skin on the underside of the tail in *P. oralis* is white but in *R. fuscipes* it is generally pale grey although some individuals have tails with very light skin colour. Surrounding the eye in *P. oralis* is a narrow, about 1 mm across, ring of black hair but in *R. fuscipes* the fur coloration is uniform right to the eyelid. The fur coloration on the tail and the black ring around the eye are significant features that distinguish *P. oralis* from *R. fuscipes*.

Although all rodents have six pads on the sole of the hind foot, differences in the shape and relative positions of these pads are useful characters for distinguishing different species. Pads on the hind foot of *P. oralis* individuals are smooth, oval or rounded in the smaller ones, and uniformly raised around their perimeter. Pads on the hind foot of *R. fuscipes* individuals have various shapes and are not uniformly raised. The long narrow pad, nearest the heel, tapers level with the sole at its heel end. The pads of the centre pair are triangular with the raised apex towards the toes and are slightly concave. The inner pad of the pair nearest the toes tends to be triangular with its apex towards the heel and uniformly raised. There are other more subtle differences.

With experience, there are behavioural mannerisms when the species are handled that are noticeably different between *P. oralis* and *R. fuscipes*: the former is gentle, calmer and unhurried but the latter is quicker and more agitated. Body odour is also different: *P. oralis* has a delicate sweet almost pleasant aroma but *R. fuscipes* has a strong, rather pungent smell.